



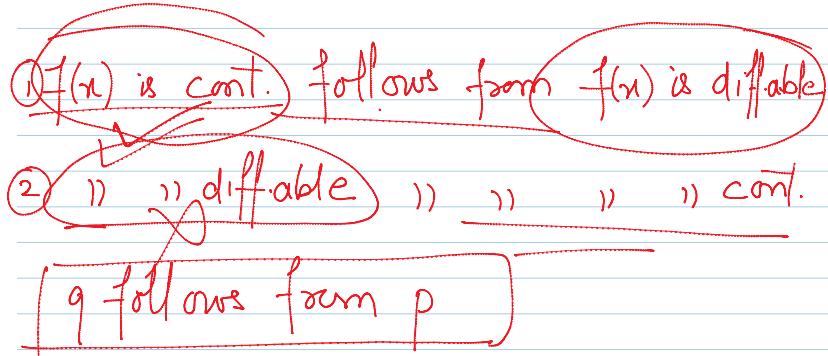
The statement $p \rightarrow q$ is called a conditional statement because $p \rightarrow q$ asserts that q is true on the condition that p holds. A conditional statement is also called an implication.

The truth table for the conditional statement $p \rightarrow q$ is shown in Table 5. Note that the statement $p \rightarrow q$ is true when both p and q are true and when p is false (no matter what truth value q has).

Because conditional statements play such an essential role in mathematical reasoning, a variety of terminology is used to express $p \rightarrow q$. You will encounter most if not all of the following ways to express this conditional statement:

- "if p , then q "
- " p implies q "
- " p only if q "
- " p is sufficient for q "
- " q if p "
- " q whenever p "
- " q when p "
- " q is necessary for p "
- " q follows from p "
- " q unless $\neg p$ "

- " p implies q "
- " p only if q "
- "a sufficient condition for q is p "
- " q whenever p "
- " q is necessary for p "
- " q follows from p "



$P: f(x)$ is diffable.

$$P \rightarrow q$$

$$q \rightarrow P \quad \boxed{f(x) = |x| \text{ at } x=0}$$

$q: \rightarrow \rightarrow$ cont.

① $f(x)$ is cont. unless $f(x)$ is not diffable

$$P \rightarrow q$$

q unless np

② \rightarrow diffable \rightarrow \rightarrow cont.

$$P \rightarrow q$$

If you study hard then you get a good job

You get good job unless you don't study hard.

You study hard unless you don't get a good job.

Let p be the statement "Maria learns discrete mathematics" and q the statement "Maria will find a good job." Express the statement $p \rightarrow q$ as a statement in English

① If Maria learns DM, then Maria will find a good job.

② Maria will find a good job whenever Maria learns DM

③ For Maria to get a good job it is suff Nec. that Maria learns DM.

$P \rightarrow q$
For q to be suff.

④ Nec. (b) Suff.

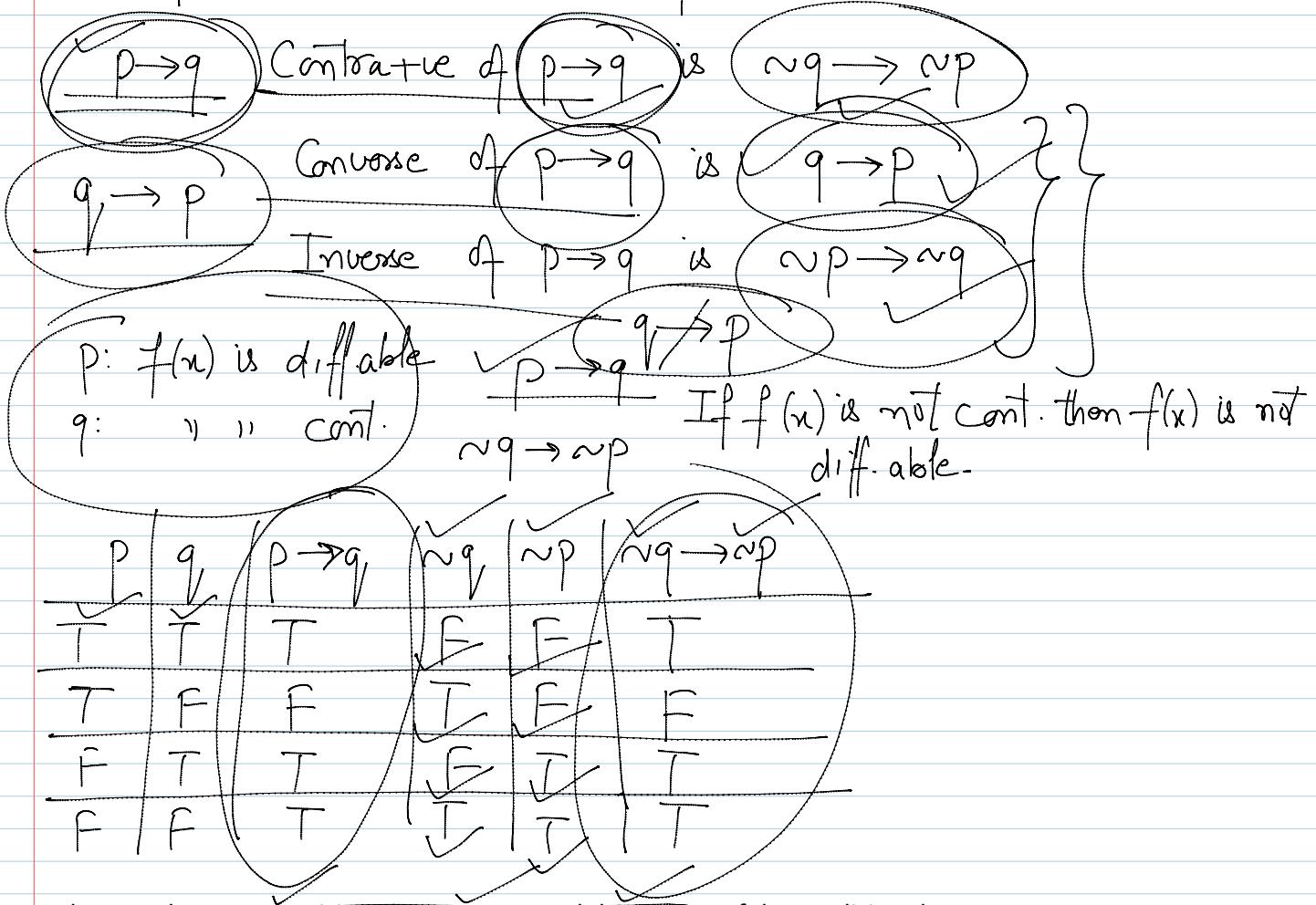
~~$p \rightarrow q$~~ ✓ $\neg q$ $\neg p$ \neg \neg

For $\neg q$, p is suff.

For $\neg p$, q is Nec.

- ① Maria will find a good job unless (she) doesn't learn DM.
- ② Maria learns DM unless (she) will not find a good job.

Contrapositive, Converse, Inverse of a Conditional Statement



What are the contrapositive, the converse, and the inverse of the conditional statement "The home team wins whenever it is raining?"

~~$p \rightarrow q$~~ ✓ $\neg q$ $\neg p$

P: It is raining
q: Home teams wins.

$\neg p \rightarrow \neg q$
 $\neg q \rightarrow \neg p$

q whenever P
If it is raining then the home team wins.

If whenever P If it is raining then the home team wins.

Contrapositive If home team doesn't win then it is not raining.

Converse If home team wins then it is raining.

Inverse If it is not raining then the home team doesn't win.